Lowering Physician Hospital Resource Consumption Using Low-Cost Low-Technology Computing

Craig C. Johnson, MSPH, MPH, Anderson Area Medical Center, Anderson SC
Margaret Martin PhD, Medical University of South Carolina, Charleston SC

Anderson Area Medical Center physicians have been provided disease and procedure specific profiles of their practice experience for more than five years. For four years, physicians were provided reporting, in a variety of formats, detailing their clinical outcomes and consumption of hospital resources in treating patients with acute myocardial infarction (AMI), pneumonia, cholecystectomy, stroke, congestive heart failure (CHF), and total hip replacement. For the past eighteen months physicians have been provided a uniform format of monthly physician-specific reporting for stroke, AMI, pneumonia, diabetes, CHF, cholecystectomy, total hip replacement, newborn delivery, angina, and hernia repair. Using only a modest PC platform with database, word processing, and graphics programs operating in a DOS environment, an effective disease/procedure reporting program is provided to medical staff with 3 person-days of effort per month.

INTRODUCTION

Physicians receive approximately 20% of health care dollars, but physician decisions create 80% of the costs of medical care[1]. To effect significant changes in the use of expensive medical resources while preserving optimal outcomes for patients it has been proposed the modification of decision making behavior is essential for success. The literature is replete with evidence that physicians are quite responsive when provided with a variety of data, be it the results of randomized clinical trials, financial information, or details about variations in physician practice patterns.

Several authors have reported success in providing physicians information about the cost of services at the time of ordering. Cummings[2] described a study where 36 second and third-year residents and 23 clinical faculty were asked to review four case studies, each describing ambiguous symptoms and to indicate on an attached order form the tests they would order for each patient. Physicians randomly assigned to the experimental group, received a test order form on which the price of each test was provided. The control group was given the same order form without pricing information. Those physicians provided with pricing information, ordered total tests costing 31.1% less than those ordered by physicians not provided with pricing information.

James[3] reports that it is not directly possible to determine if inter-physician variation in use of resources is appropriate or not. He provided blinded study results to hospitals and physicians and physicians to act on as they saw fit. He reported very high inter-physician variation in resource utilization in every clinical area for patients receiving Transurethral Prostatectomy. The only action taken after the initial study was to share confidentially with physicians this variation data and nine months later to make an assessment to determine if any impact was made on resource utilization. Average Length of stay (LOS), as but one measure of utilization, dropped 37% from 4.40 days to 2.83 days.

Lamas[4] found that the publication of definitive study results in and of itself was sufficient to change physician behavior in terms of drug and test ordering, confirming that physicians are interested in doing excellent work and will read major journals to stay clinically current.

Zieve[5] found that providing physicians with physician-specific ordering information, as reflected in drug-specific charges, produced large savings for a 500-bed hospital. Providing physicians with charge information resulted in savings of $179,000 in the first year on NSAIDs alone and savings of $119,000 for CCBs.

An experimental-control group study[6] was carried out at Anderson Area Medical Center in which the experimental variable consisted of a one-time exposure of physicians to clinical and financial specifics regarding their individual treatment and management of pneumonia patients. It was found that providing physicians with specific information about their practice behavior resulted in these same physicians using fewer hospital resources as expressed in total billed charges and Length of Stay (LOS). The experimental group's 6.8 days was significantly lower than the control group's 10.0 days. During one six-month period the experimental

0195-4210/95/$5.00

group had a statistically significant lower mean charge ($5,988) than the control group ($10,051). At the same time there was no compromise in outcomes for patients as measured by mortality, readmission rates, or infection/complication rates. The improvement in resource utilization was observed for two years following the provision of practice specific data to the experimental physicians.

METHODS

Background

A research group was formed at AAMC in 1987 to develop a severity-adjusted physician education system. This system used a hybridization of genetic algorithms, neural networks, abductive-inductive methodology, case modelling, and complex in-house written programs along with statistical packages, word processing, and graphics generators to produce physician-specific reporting. The statistical results were most impressive and external observers cited the predictive capabilities as being among the best available.[7] Significant changes in physician behavior were reported[6].

In 1992, all but one member of the research group relocated to another state to continue development in a proprietary domain. The group has continued to enjoy significant success as reflected in its receipt of the 1994 Healthcare Technology Innovations Award for a neural-network based 'heart attack' predictor.

The technologies and expertise required to develop and maintain high-quality severity-adjusted programs are not available in most hospitals and the acquisition of commercial products and/or expertise can be exceptionally expensive. Some commercial products require hospitals to hire nurses to do extensive chart review of all charts and this, coupled with licensing fees, can drive annual costs to over $500,000 for a severity-adjusted reporting system.

Development

Believing it possible to effect significant behavioral changes in physician-practice behavior without using the complex technologies accessible only to highly-trained individuals, we developed a new physician-specific reporting format. It incorporates graphical concepts of statistical process control (SPC), uses widely-disseminated inexpensive software, requires no chart review or coding, and makes a combination narrative and graphical report available to physicians at a rather modest cost. Only moderate technical skills are require to produce reports.

The data used as input for the Physician Practice Performance system is derived from the Medical Record Abstract System (MRA) and the UB92 billing files. The hospital maintains the MRA and billing systems on an AS400 operating with Ibax software products. An extract program, written in RPG, is used to obtain 111 data elements for each patient, for a selected time frame, from the MRA and UB92 and writes them to a disk file. PC Support is used to download this file in an ASCII delimited format. 149,000 in-patient episodes have been downloaded since 1988.

Like its more complex predecessor, the present Physician Practice Performance (PPP) system operates on a PC DOS platform (486-50) and uses this download file as its only data source. A new download file is obtained twice a year to update the expanding local PC patient data base. Inherent systemic delays in final billing of accounts results in a 60-120 day lag before many records will appear on the MRA. Because of this lag, new download requests will include a time frame beginning a year prior to the date-of-request to obtain records previously not captured in download files.

The usual UB92 demographic and financial data elements are downloaded along with several dozen elements from the MRA. The extract program groups financial data into categories including lab, pharmacy, radiology, respiratory care, total ancillary, and total patient charges. It also obtains financial class, payor codes, and admit and discharge codes. The Medical Records Department has been committed to a deep level of coding and has been providing robust ICD-9 coding to the MRA for eight years, knowing the deeper coding was being used for research and physician-practice reporting. The coding has included up to fifteen ICD-9 diagnosis codes and up to ten ICD-9 procedure codes. In addition, other data elements profile hospital infections, complications, blood utilization, use of special care units, OR and post-op mortality,

The ASCII download file is imported into an R-Base table. R-base is a relational data-base program capable of handling tables with millions of rows and tens of million of cells in a single table. R-Base provides some 'hard-wired' statistical functions that are user friendly as well as allowing one to write programs of immense complexity, if desired. In our case, R-Base is used as a data-handler and very simple programs were written to perform statistical calculations.

For the physician reporting described in this paper, R-Base is used to calculate physician-specific and hospital-wide rates for 1) complications, 2) infections, 3) mortality, 4) readmissions, per-diem charges, 5) charge ratios, 6) use of consults, 7) LOS, and 8) six charge totals (total, ancillary, pharmacy, respiratory, lab,radiology). It is also used to calculate demographic variables including sex, age, and race.

The R-base programming used is little more than a series of chained macros within the province of those just beginning to develop their computational skills. We have used Word Perfect 5.1 to write all of the R-base macros. Word Perfect proves a robust editor for writing program code. Word Perfect documents saved as DOS files are accessible to R-base as source code without further modification.

Report Structure

Each physician report includes a title page, a two-page narrative text containing comparative statistics, a one-page table providing inter-physician comparisons for eight variables, and three final pages, each containing three pareto charts depicting physician performance for a key resource or outcome variable.

System Structure

Physician reporting is created using a PC 486-50 with DOS 5.0 as its operating system. R-Base 4.0, Word Perfect 5.1, and Harvard Graphics 3.0 are used to generate the narrative and graphical components of the reports. PC-Support is resident to provide access to the AS-400 mainframe.

Report components for each disease or procedure are kept in separate subdirectories on a hard drive. Components are reused each year when an updated disease report is produced. We find that keeping files and documents in separate directories make long-term maintenance much simpler.

Word Perfect 5.1 files include separate ones for 1) report title page, 2) two-page physician narrative summary (a primary merge document with merge fields), 3) a physician-specific variables table, 4) physician cover letter (a primary merge document with merge fields), 5) name/address file for letter generation (a secondary merge data file), 6) resource/outcome data file for loading narrative reports (a secondary merge data file).

Nine Harvard Graphics files are maintained for each disease with each file containing a single pareto chart. These are readily updated and consume very small amounts of disk space.

R-base command files and program files are kept resident in the R-Base main directory. Disease-specific extensions are used for file names so as keep them identifiable for a particular disease

Procedure

R-base macros are adjusted for new date ranges prior to generating data for an updated report. The data generated is written to a disk file, reformatted with Word Perfect and printed on paper. The data is then keyed into the secondary merge document for the narrative report and into the variables table. The physician name/address file is updated for the cover letters. Merges are completed for the narrative report and the cover letter. The Harvard Graphic pareto charts are updated with the new data values. Individual physician values are highlighted in color. The title page date is changed and printed. The title, text, and graphics are assembled and three-hole punched. These are then mailed to the physician with the signed cover letter.

RESULTS

Acute Myocardial Infarction

On February 7, 1994, twenty physicians treating AMI were mailed the report containing the narrative text, tabular display of data profiling inter-physician variation for seven indicators of outcomes and resource consumption and six pareto graphs displaying physician ranks for mortality, complication rate, infection rate, 31-day readmissions, average total charges, and LOS. Physician-specific data was provided for all the physicians but was blinded for identity for all but the recipient.

Additional histograms were provided summarizing the physician group experience with AMI. Hospital mortality comparisons to HCFA national data and the data from the National Registry for Myocardial Infarction were given. The use of thrombolytics, heparin, aspirin, beta blockers, calcium channel blockers, and nitrates during the early phases of treatment was summarized as well.

The first 134 patients treated after the reporting was provided (3-8-94 to 8-7-94) were profiled. A similar-size (131) group of patients treated just before the reporting was received by the physicians (11-1-93 to 2-7-94) was profiled. The results are shown in Table 1. If this level of charge

reduction was annualized, the positive effect on total charges would be $592,800. 2 outliers were retained in each group. With the outliers removed the effect of education was maintained. Inter-physician variation was reduced for LOS and average total charges following the educational reporting.

Table 1. Result of sending physician-specific reporting to twenty physicians treating AMI.

REPORTING EFFECT: AMI 2-7-94			
	Before	After	Net Effect
LOS (days)	7.78	6.30	1.48
Avg Total $	$14,803	$13,283	-$1,520
# of patients	131	134	n/a

Pneumonia

On March 17, 1994, 34 physicians treating pneumonia were provided with the same reporting format.

The first 134 patients treated after the reporting was provided (3-25-94 to 8-30-94) were profiled. The 139 patients treated just before the reporting was received by the physicians (1-1-94 to 3-17-94) were also profiled. The results are shown in Table 2. If this level of charge reduction was annualized for the estimated 483 cases treated per year at AAMC, the reduction of total charges would be $794,052.

Two and three outliers were again retained in the groups. With the outliers removed the effect of education on LOS was actually exaggerated with a reduction of 1.19 days in LOS. The removal of outliers had a moderate effect on the drop in average charges; $1,326 rather than $1,644. Effects on inter-physician variation were less pronounced with standard deviations for LOS and average total charges not reduced to the extent seen with the AMI patients.

Table 2. Result of sending physician-specific reporting to 34 physicians treating pneumonia.

REPORTING EFFECT: PNEUMONIA 3-17-94			
	Before	After	Net Effect
LOS (days)	8.78	8.21	0.57
Avg Total $	$12,764	$11,120	-$1,644
# of patients	139	134	n/a

Total Hip Replacement

The reporting process began with oral presentation of summary data for elective hip replacement and repair of femur fracture (with overhead transparencies) in the monthly department meeting of the Orthopaedics Service (OS) in December, 1992. During the first week of Feb, 1993 at the monthly OS meeting, more specific data were presented, including surgeon-specific data detailing consumption of hospital resources as measured by charges and LOS. Written summary documents containing surgeon specific-data were given to those surgeons present and sent to the two that were not present at the meeting.

Individual reports given or mailed to the surgeons identified them individually but retained confidentiality of the comparison surgeons. The educational activities encompassed a two-month period from Dec 1,1992 through Feb 3, 1993. This reporting scenario preceded that of AMI and pneumonia and varied slightly in format in that oral presentation was first made of the written data.

Table 3 presents the results for all elective hip replacements before and after the reporting period. Average total charges were adjusted for inflation and set to 1992 dollars. A seven percent inflation factor was used to correct for inflation based on a calculation provided by the hospital accounting department. At an estimated per-case reduction of $3,496, the 42 patients treated after the educational exposure generated $146,832 in overall charge reductions in ten and a half months. A comparison control group of patients treated by the same surgeons was constructed to validate the education effect.

Table 3. Result of sending physician-specific reporting to 7 surgeons performing elective total hip replacement.

REPORTING EFFECT: TOTAL HIP REPLACEMENT 12-92 TO 2-93			
	Before	After	Net Effect
LOS (days)	13.75	9.93	3.82
Avg Total $	$22,103	$18,607	-$3,496
# of patients	53	42	n/a

A case-management (CM) protocol was implemented at AAMC for total hip replacement in

late 1993 and the first patient entered the management pathway on 12-16-93. Surgeons performing total hip replacement were not provided additional surgeon-specific comparative reporting during the course of pathway development. The patients used for this post-reporting comparison did not participate in CM.

The actual aggregate reductions in average total charges for each of the three groups of patients profiled following educational reporting to physicians were $203,680 (AMI), $220,296 (pneumonia), and $146,832 (hip replacement). The total benefit for these three educational reports was $570,808. If the educational effects persist for a year in the physician groups, the annualized estimate of aggregate charge reductions for 390 AMI patients, 483 pneumonia patients, and 52 hip patients is $1,568,644. Cost savings to the hospital would be near $706,000.

DISCUSSION

Many investigators have found there to be no severity basis for many variations in the consumption of hospital resources. Chassin, in 1987, concluded that differences in appropriateness cannot explain geographic variations in the use of expensive procedures, such as coronary angiography, carotid endarterectomy, and upper GI endoscopy[8]. Welch found a two-fold geographic variation in physician expenditures per admission and cited a lack of consensus among physicians about which services are required[9].

Physicians are interested in providing high quality care and in the present era of managed care and intense competition, they are becoming much more interested in making this care cost effective. Hospitals are equally interested in positioning themselves in an intensely competitive market by providing cost-effective care. Providing physicians with simple, easily assimilated data that profiles inter-physician variations in resource consumption can be effective in reducing variation and reducing mean measures of resource consumption.

Berwick points out that variations, such as differences in practice style that are not grounded in knowledge or reason, can be reduced without undermining the professional autonomy, dignity, or purpose of health care professionals[10]. Our physician-specific data is provided in a strictly confidential manner to physicians only and has not been made available to department chairs, hospital management, PROs, or third party payers.

Education-based physician practice reporting is an effective tool in encouraging more resource-efficient decision making on the part of medical staff members. Average LOS and total charges can be reduced significantly by providing physicians with profiles that show them their relative rankings with peers for several outcome and resource variables. Importantly, this can be done with a very low-cost low-tech computing system utilizing only moderate technical skills and about three man-days per month. The benefits to institutions in competitive markets, third-party-payers, tax-payers, and patients do not need enumeration here.

Our process is non-proprietary and examples of the documents and details of our procedures are available to those with an academic interest or a desire to implement such reporting in their facilities.

References

1. Harris JS: Why doctors do what they do: determinants of physician behavior. J Occ Med 1990; 32:1207-1220.
2. Cummings KM, Frisof KB, Long MJ, Hrynkiewich G: The effects of price information on physician's test ordering behavior. Med Care 1982; 20:293-301.
3. James B: Transurethral prostatectomy utilization study: Technical Report. Intermountain Health Care, 1989.
4. Lamas GA, Pfeffer MA, Hamm P, Wertheimer J: Do the results of randomized clinical trials of cardiovascular drugs influence medical practice? NEJM 1992; 327:241-248
5. Zieve, FJ, Ciesco E: Computer-focused modifications of physician prescribing behavior. Proc, 17th SCAMC, AMIA, Nov,92.
6. Johnson CC, Martin M, Epstein SM, Lee JD: The effect of a physician education program on hospital length of stay and total patient charges. J SCMA 1993; 89:293-301.
7. Ed Gheer, in presentation at American College Of Physician Executives, Atlanta, 1991.
8. Chassin MR, Kosecoff J, Park RE, et al. Does inappropriate use explain geographic variations in the use of health care services? JAMA 1987; 258:2533-2537.
9. Welch WP, Miller ME, Welch G, et al. Geographic variation in expenditures for Physician's services in the United States. NEJM 1993; 328:621-627.
10. Berwick DM. Controlling variation in health care. Med Care 1991; 29:1212-1225.